

SOUTH AMERICAN LINUM, A SUMMARY

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Linum is a genus of perhaps 150 species, widely distributed throughout the temperate and subtropical regions of the world. The greatest number and diversity of species are in the eastern Mediterranean region, where all of the usually recognized sections of the genus are represented. Studies of the North American flaxes (Rogers, 1963, 1968, 1969) have shown that they are related to and probably had their origin among Old World plants. It has seemed worthwhile to learn more about the relationships of the several South American species. The present paper, for which much of the information comes from the dissertation of Mildner (1971), summarizes the results of this study. With the aid of a Sigma Xi Grant-in-Aid of Research to the senior author it has been possible for both of us to observe most of the species in the field and to collect various kinds of materials. Herbarium specimens have been borrowed from a number of institutions and the help of the several curators is gratefully acknowledged. For certain South American species the reexamination of specimens housed in Old World herbaria will be needed before their final circumscription and typification can be determined and synonymy finalized. When these questions have been resolved, a revision of the genus in South America, including detailed descriptions of the species, can be presented, but there are enough data now available to summarize many of the relationships of the South American plants to each other and to species in other parts of the world.

Although *Linum bienne* Huds., *L. usitatissimum* L. and perhaps, occasionally, other Old World species may be found as adventives or escapes from cultivation, the native South American species are confined to two sections of the genus, *Cliococca* and *Linastrum*. The former monotypic section differs so greatly from the rest of the genus that

it is much better treated as a separate genus (Rogers & Mildner, 1972). *Linastrum* is probably the largest and most widespread section of the genus, being found not only in several parts of the Old World, but including all but two or three of the approximately forty native North American species.

There may be as many as seventeen or eighteen taxa in South America. Their total known distribution (together with the presumed direction of increased specialization) is shown in Figure 1. As can be seen, although there are minor centers of diversity in Peru and Chile, the principal concentration of *Linum* species is along the eastern side of the continent, from southeastern Brazil near Rio de Janeiro southward through Uruguay to northeastern Argentina. Two or three species are of special interest. The Brazilian plants, *L. organense* Gardn. and especially *L. smithii* Mildner, are broad-leaved plants which are very similar to the North American *L. schiedeanum* Schlecht. & Cham. (Mexico-Texas) and *L. nelsonii* Rose (Mexico-Nicaragua), as well as to several species of South Africa, such as *L. quadrifolium* L. The narrow-leaved *L. burkartii* Mildner, of Uruguay and northeastern Argentina, is also very similar to African plants such as *L. holstii* Engelm. and almost identical to the North American *L. rupestre* (A. Gray) Engelm. (Mexico-Texas). The North American species mentioned, on the basis of the comparative study of a series of characters, are believed to possess the greatest number of primitive features of any of the North American species (Rogers, 1969). Their similarity to the South African plants was also noted.

The general distribution and morphology of the whole genus and of the section *Linastrum* suggest that the transatlantic migration which accounts for these disjunct, closely related plants most likely was from the Old to the New World. Whether, in this event, the establishment of *Linum* in South America was independent of that in North America or whether the genus became established in one area in the New World and then spread to the other would

be quite conjectural. On the basis of the amount of diversification which has taken place on the two continents, if this may be used as a possible measure of the time available for evolution, it is quite clear that the amount of change that has taken place on the North American continent far exceeds that in South America. As many as thirty-five to forty species have evolved in North America, including some, such as *L. rigidum* Pursh, which are among the most highly specialized in the whole genus. Moreover, there is evidence that the genus *Hesperolinon* (and probably *Sclerolinon*) of the western United States has also evolved from North American species of the section *Linastrum* (Rogers, 1975). On the other hand, while *L. smithii*, *L. organense* and *L. burkartii* are distinctive, the South American flaxes in general are a very closely allied group of species. The following discussion will illustrate this.

The "*Linum littorale* St. Hil. complex" which ranges from east-central Brazil to Uruguay, is a troublesome one, the source of a number of named forms, varieties and species. These are described in some detail in the *Flora Illustrada Catarinensis* (Rogers & Smith, 1975) wherein *L. palustre* Gardn., a slender plant with much reduced terminal inflorescences, *L. brevifolium* St. Hil. & Naud, with racemose inflorescences, and *L. littorale*, with open inflorescences, are recognized. *Linum carneum* St. Hil. and *L. erigeroides* St. Hil., described in the same publication, are two very closely related species, characterized by thicker-textured sepals and more obtuse fruits than *L. littorale*. They range from southern Brazil to eastern Argentina. Some collections of *L. littorale*, in the southern part of its range, seem to intergrade with one or another of them. *Linum carneum* and *L. erigeroides* in turn differ only slightly from *L. scoparium* Griseb., a bushy branched species ranging from eastern Uruguay to central Argentina and northward to the Bolivian-Peruvian border near La Paz. Although there is a small geographical separation, *L. scoparium* in that area closely resembles collections of

Peruvian plants usually called *L. oligophyllum* Willd. (the identity of the type with this population needs further verification). In northern Peru and Ecuador an admixture of closely allied populations, differing only slightly from *L. oligophyllum*, have been called *L. filiforme* Urb., while in sandy coastal areas from the vicinity of Lima, Peru, to northern Chile (Paposo), small-flowered plants, also not too different from *L. oligophyllum*, are interpreted as *L. prostratum* Domb. ex Lam. (the type specimen may need verification).

Of most interest in terms of the general picture of relationships among the flaxes of western South America is the sequence of minor variations, including trends toward larger floral parts and more nearly united styles, leading from *Linum oligophyllum*, with separate styles and petals about ten mm. long, to the generally much stouter *L. macraei* Benth. of central Chile, with styles united nearly to the summit and petals up to 20 mm. long. Several of the intermediates have been named, of which *L. polygaloides* Planch., of southwestern Peru, and *L. ramossissimum* Gay, of the Fray Jorge region of central Chile, may be the most substantial. Well-defined species in Chile are the procumbent, mat-forming, highly localized *L. cremnophilum* Johnst., near Taltal, and the separate-styled *L. chamissonis* Schiede in the Concepción area.

In summary it may be said that the flaxes which grow along the eastern part of the South American continent, from southeastern Brazil southward to northeastern Argentina, display the greatest array of variation and include some species which very closely resemble plants of North America and southern Africa. There is an almost continuous series of populations extending from northeastern Argentina generally northward through western Bolivia and adjacent Peru, across the Andes in Peru and thence southward along the Pacific Coast to central Chile. The species of Brazil, Uruguay and Argentina are thought to include the least specialized of the genus on the continent in terms of their possession of characteristics found in species in

other parts of the world. The plants of Chile, particularly *Linum cremnophilum* and *L. macraei* must be considered the most highly specialized of the genus in South America. These general relationships are summarized in Figure 1.

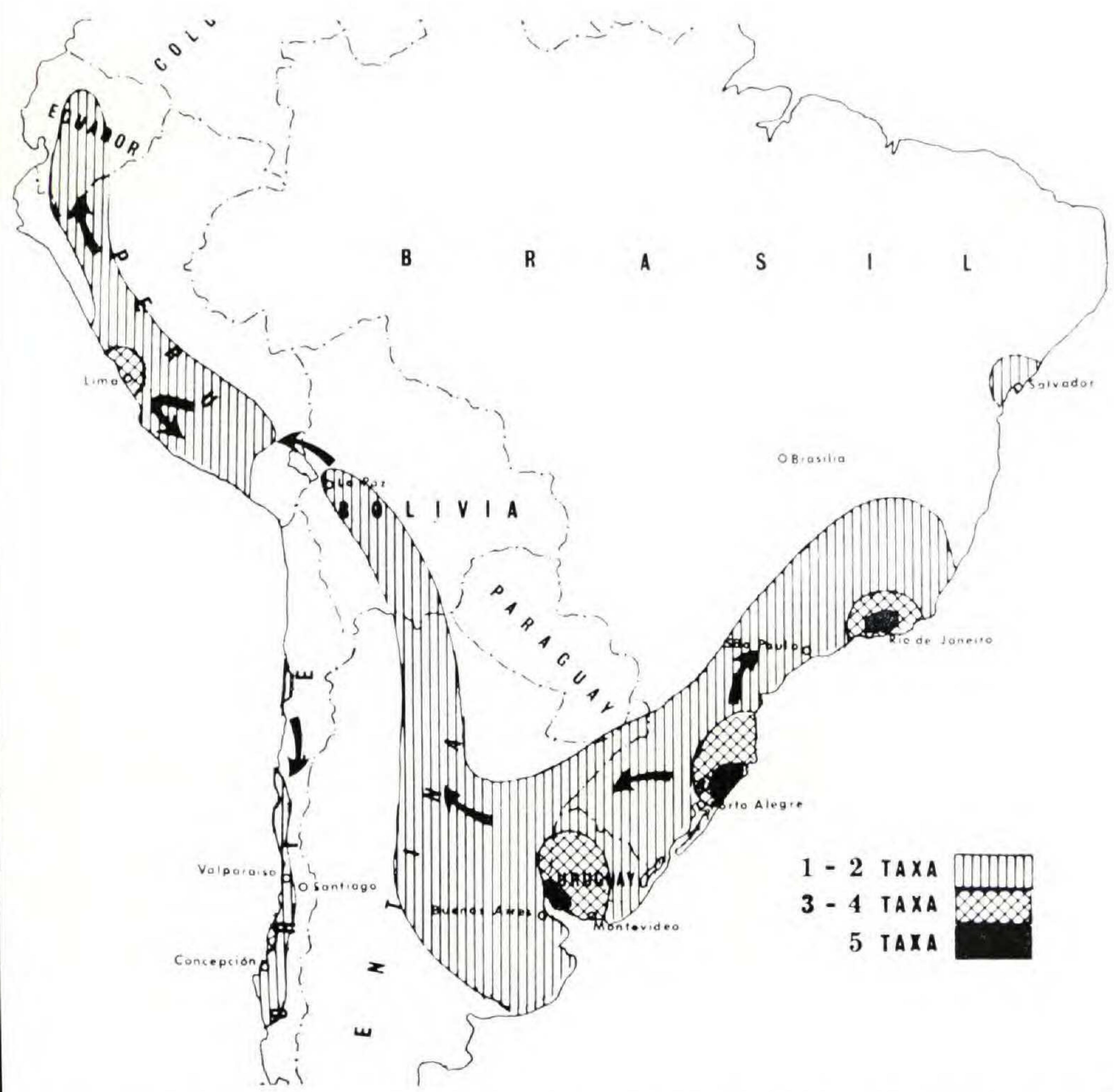


Figure 1. Distribution of *Linum* in South America, showing the direction of presumed increase in specialization.

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